Total Suspended Solids, Stable Flow, and Wet Weather Event Monitoring in the York Creek Watershed

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DRAFT

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Grand Valley State University
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1. Introduction

An investigation of streams in west Michigan was conducted to monitor the loading of Total Suspended Solids (TSS) and fluctuations in hydrology. The study sites were located in the lower Grand River watershed and included: Bass River, Sand Creek, Strawberry/Mill Creek, York Creek and an unnamed tributary north of Leonard Street and east of East Beltline (M-44). Each of these watersheds is a tributary to the Grand River and is included on Michigan's 2002 303(d) list as requiring a Total Maximum Daily Load (TMDL) because they were identified as not supporting the designated use for biota. The data for each watershed are summarized in individual reports. This report examines the discharge and loading of TSS at 5 locations in York Creek under base flow (dry conditions) and during storm events. The data from this project will be used to develop a Biota TMDL for the York Creek watershed.

2. Monitoring Locations and Watershed Description for York Creek

York Creek has a 2,119 acre watershed located in Kent County (Figure 2.1). Land use in the watershed is primarily residential (40%), commercial, industrial, and other developed area (24%), and forests, fields, and wetlands (20%). A summary of land use/and cover statistics is presented in Table 2.1. Stormwater discharge outfalls were inventoried and five stream locations were selected for flow and TSS monitoring (Figure 2.1). Descriptions and coordinates for the stormwater outfalls and monitoring stations are provided in Table 2.2. Data for the standard Michigan Department of Natural Resources (MDEQ) Steam Survey Form were collected at each monitoring station. The Steam Survey Forms are included in Appendix 1. Photographs of each monitoring station and stormwater location were taken and included in Appendix 2.

3. Sampling Methods

Dry weather sampling was conducted on 6/28/04, 7/14/04, and 7/28/04. One grab sample was collected from each station. Dry weather sampling was preceded by at least 72 hours without precipitation as measured at the Grand Rapids Airport.

Wet weather sampling was conducted on 8/02/04, 8/25/04, and 10/23/04. The wet weather runoff events were in response to precipitation events of 0.1, 1.1 and 1.3 inches that occurred in a 2 hour time period. Sampling was initiated near the start of each rain event. During the rise and fall of the hydrograph, individual grab samples were collected manually at hourly intervals. Wet weather sampling events lasted from 4-6 hrs. TSS samples were collected at the centroid of each stream transect where approximately 50% of cumulative flow occurred. If the stream was wadeable, samples were collected by immersing a 500 milliliter (ml) polyethylene bottle at mid depth. If the stream was not wadeable, a thief sampler was used. Sample containers were placed in coolers with ice

Figure 2.1 York Creek Watershed.

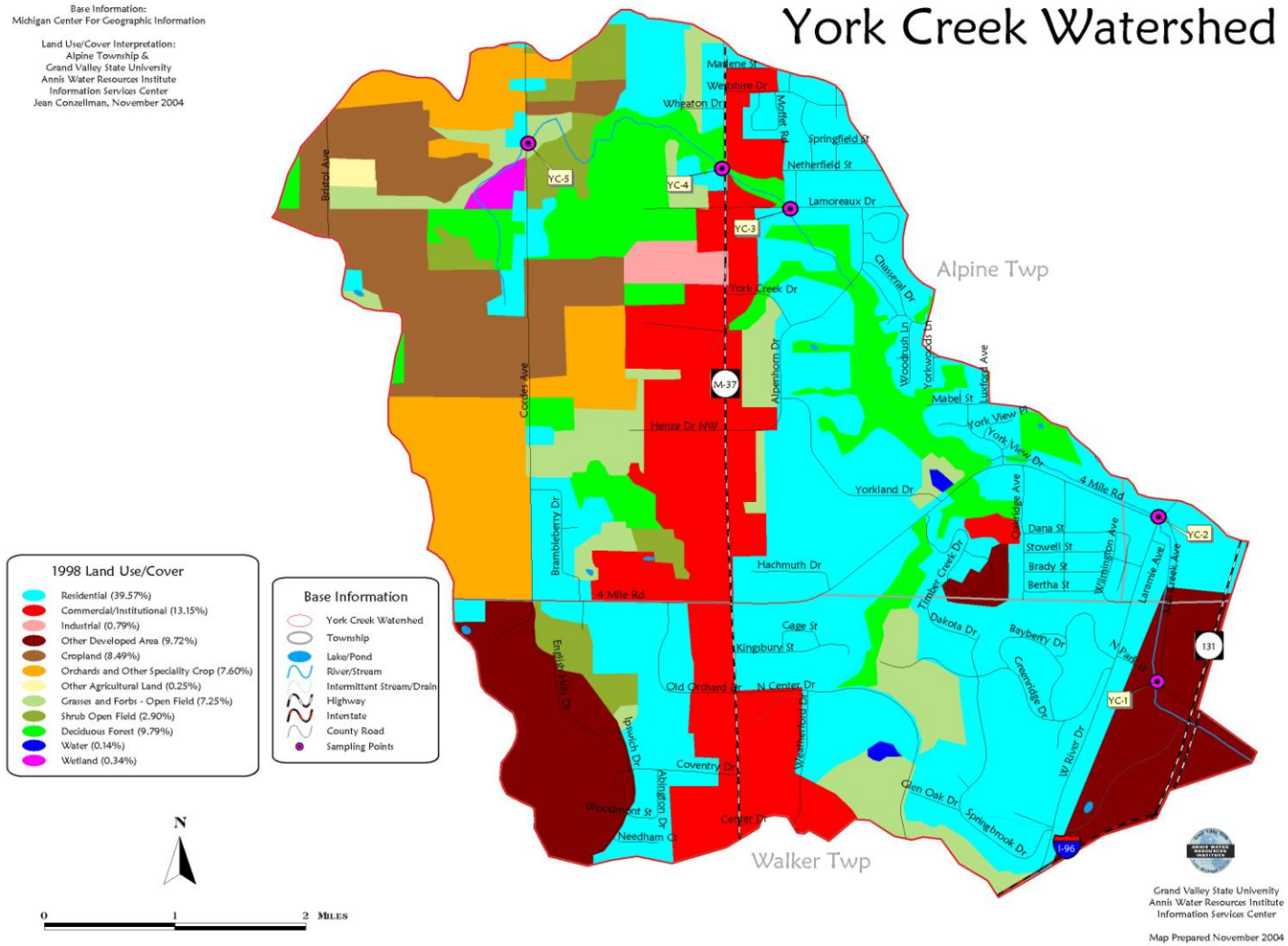


Table 2.1 York Creek Land Use and Cover Statistics.

York Creek Land Use/Cover		
Map Description	**Acres**	**%**
Commercial/Institutional	279	13
Cropland	180	8
Deciduous Forest	208	10
Grasses and Forbs - Open Field	154	7
Industrial	17	1
Orchards and Other Specialty Crop	161	8
Other Agricultural Land	5	0.2
Other Developed Area	206	10
Residential	838	40
Shrub Open Field	62	3
Water	3	0.1
Wetland	7	0.3
Total	2119	100

Table 2.2 York Creek Monitoring Stations, Stormwater Outfalls, and Coordinates.

Location and GPS Coordinates				
Type	Location	Site ID	Lat. (N)	Long. (W)
Monitoring	N. Park Street (Upstream)	YC-1	43.02628	-85.6681
Monitoring	W. River Drive (Upstream)	YC-2	43.03228	-85.6684
Monitoring	Lamoreaux Drive (Upstream)	YC-3	43.04362	-85.6865
Monitoring	Alpine Avenue (M-37) (Downstream)	YC-4	43.04490	-85.6894
Monitoring	Cordes Avenue (Downstream)	YC-5	43.04603	-85.6995
Stormwater	Retention Pond			
Stormwater	Retention Pond			
Stormwater	Retention Pond			

and kept at 4^{o}C. One field blank sample was collected for every 20 investigative samples. One duplicate sample was collected for every 10 investigative samples.

Flow was measured at each location using a Marsh-McBirney Flow Mate 2000 velocity meter or flume according to USGS protocols. Transects were established at each location and water depth measurements were collected using a bridge board and sounding reel or a self-leveling rod. The location of each transect was marked by stakes. Depending on stream width, 4 – 12 equally spaced points along each transect were used for depth and

flow measurements. Transect locations were selected to minimize interferences from structural anomalies such as debris jams, bridges, and highly eroded areas. Water elevations were measured at the MDEQ reference point located on each culvert or bridge. Flow measurements were collected during each wet and dry weather sampling event. If the stream depth was < 2.5 feet, flow measurements were taken at 0.6 depth at each transect point. If depths were > 2.5 feet, flow measurements were taken at 0.2 and 0.8 depths. If stream velocity was too slow to accurately measure (<0.05 cubic feet/second), a calibrate flume was installed in the channel. Discharge was then estimated by measuring the water level and using the rating curve for the flume.

4. Analytical Methods

Total Suspended Solids (TSS) was measured gravimetrically by Environmental Protection Agency (EPA) Method 160.2. A complete method description was provided in the Quality Assurance Project Plan (QAPP). One laboratory blank and one laboratory duplicate were analyzed for every ten investigative samples.

5. York Creek Base Flow Data

Base flow and TSS loading data for the York Creek watershed are summarized in Table 5.1. Rating Curves developed by the MDEQ for each monitoring station and the location of surface elevation reference points are provided in Appendix 3.

6. York Creek Storm Event Data

Storm flow and TSS loading data for the York Creek watershed are summarized in Tables 6.1, 6.2, and 6.3 for the 0.1", 1.1", and 1.3" rainfall events, respectively.

7. Deviations from the Quality Assurance Project Plan

Some of the field and laboratory duplicates with low suspended solids (<10 mg/l) exceeded the RPD limits. The difference between duplicates ranged from 1-3 mg/l. The small relative difference between duplicates reflects normal variations associated with sampling and analysis at low concentration levels. Based on professional judgment, the data was not qualified. The results of field and laboratory duplicates and blanks were submitted in a separate Quality Assurance report.

Table 5.1 Base Flow TSS Loading Data for York Creek.

Site ID:	Name	Discharge m^3/ sec	Discharge cfs	TSS mg/l	Loading lb/d	Surface ft	Method
June 29, 2004							
YC-1	North Park St	0.06	2.12	3	34	6.34	Meter
YC-2	West River Drive	0.06	2.12	2	23	7.23	Meter
YC-3	Lamoreaux Drive	0.004	0.14	4	3	7.06	Meter
YC-4	Alpine Ave (M-37)	0.002	0.07	3	1	4.46	Weir
YC-5	Cordes Ave	0.001	0.04	6	1	5.18	Flume
July 14, 2004							
YC-1	North Park St	0.05	1.77	1	10	6.30	Meter
YC-2	West River Drive	0.04	1.41	1	8	7.23	Meter
YC-3	Lamoreaux Drive	0.001	0.02	1	0.1	7.13	Flume
YC-4	Alpine Ave (M-37)	DRY	DRY	X	X	DRY	X
YC-5	Cordes Ave	DRY	DRY	X	X	DRY	X
July 28, 2004							
YC-1	North Park St	0.05	1.77	3	29	6.30	Meter
YC-2	West River Drive	0.03	1.06	2	11	7.26	Meter
YC-3	Lamoreaux Drive	0.003	0.11	1	0.6	7.13	Flume
YC-4	Alpine Ave (M-37)	0.001	0.04	6	1.1	4.49	Flume
YC-5	Cordes Ave	DRY	DRY	X	X	DRY	X

Table 6.1. York Creek TSS Loading Data for the 0.1 Inch Rain Event on 8/25/04

Site ID:	Name	Discharge m^3/ sec	Discharge cfs	TSS mg/l	Loading lb/d	Loading lb/hr	Water Elevation (ft)	Method
				5:00				
YC-1	North Park Street	0.07	2.47	2	27	1.11	6.43	Meter
YC-2	West River Drive	0.06	2.12	1.5	17	0.71	7.12	Meter
YC-3	Lamoreaux Drive	Dry	X	X	X	X	X	X
YC-4	Alpine Avenue (M-37)	Dry	X	X	X	X	X	X
YC-5	Cordes Avenue	Dry	X	X	X	X	X	X
				6:00				
YC-1	North Park Street	0.08	2.82	15	228	10	6.25	Meter
YC-2	West River Drive	0.07	2.47	11	146	6	7.10	Meter
YC-3	Lamoreaux Drive	Dry	X	X	X	X	X	X
YC-4	Alpine Avenue (M-37)	Dry	X	X	X	X	X	X
YC-5	Cordes Avenue	Dry	X	X	X	X	X	X
				7:00				
YC-1	North Park Street	0.14	4.94	25	665	28	6.18	Meter
YC-2	West River Drive	0.11	3.88	21	439	18	7.05	Meter
YC-3	Lamoreaux Drive	Dry	X	X	X	X	X	X
YC-4	Alpine Avenue (M-37)	Dry	X	X	X	X	X	X
YC-5	Cordes Avenue	Dry	X	X	X	X	X	X
				8:00				
YC-1	North Park Street	0.11	3.88	14	293	12	6.21	Meter
YC-2	West River Drive	0.09	3.18	8	137	6	7.09	Meter
				9:00				
YC-1	North Park Street	0.08	2.82	10	152	6	5.67	Meter
YC-2	West River Drive	0.07	2.47	5	67	3	7.11	Meter

Table 6.2. York Creek TSS Loading Data for the 1.1 Inch Rain Event on 8/02/04

Site ID:	Name	Discharge	Discharge	TSS	Loading	Loading	Water	Method
		m^3/ sec	cfs	mg/l	lb/d	lb/hr	Elevation (ft)	
15:00								
YC-1	North Park Street	0.05	1.77	2	19	0.79	6.33	Meter
YC-2	West River Drive	0.05	1.77	1.5	14	0.59	7.12	Meter
YC-3	Lamoreaux Drive	Dry	X	X	X	X	X	X
YC-4	Alpine Avenue (M-37)	Dry	X	X	X	X	X	X
YC-5	Cordes Avenue	Dry	X	X	X	X	X	X
16:00								
YC-1	North Park Street	1.62	57.20	389	119785	4991	4.31	B. Board
YC-2	West River Drive*	1.11	39.19	1262	266268	11094	4.69	B. Board
YC-3	Lamoreaux Drive	0.08	2.82	288	4379	182	6.69	Meter
YC-4	Alpine Avenue (M-37)	0.06	2.12	195	2224	93	4.20	Meter
YC-5	Cordes Avenue	0.03	1.06	852	4858	202	4.59	Meter
17:00								
YC-1	North Park Street	1.60	56.50	629	191297	7971	4.39	B. Board
YC-2	West River Drive*	1.23	43.43	630	147293	6137	5.77	B. Board
YC-3	Lamoreaux Drive	0.06	2.12	177	2019	84	6.69	Meter
YC-4	Alpine Avenue (M-37)	0.1	3.53	459	8725	364	3.90	Meter
YC-5	Cordes Avenue	No Flow	X	X	X	X	5.02	X
18:00								
YC-1	North Park Street	1.06	37.43	206	41506	1729	4.88	B. Board
YC-2	West River Drive*	0.88	31.07	73	12211	509	6.04	B. Board
YC-3	Lamoreaux Drive	0.08	2.82	398	6052	252	6.72	Meter
YC-4	Alpine Avenue (M-37)	0.05	1.77	208	1977	82	4.17	Meter
19:00								
YC-1	North Park Street	0.53	18.71	123	12391	516	5.67	Meter
YC-2	West River Drive*	0.41	14.48	84	6546	273	6.49	Meter
YC-3	Lamoreaux Drive	0.03	1.06	105	599	25	6.82	Meter
YC-4	Alpine Avenue (M-37)	0.03	1.06	77	439	18	4.30	Meter

Table 6.3. York Creek TSS Loading Data for the 1.3 Inch Rain Event on 10/23/04.

Site ID:	Name	Discharge	Discharge	TSS	Loading	Loading	Water	Method
		m^3/ sec	cfs	mg/l	lb/d	lb/hr	Elevation (ft)	
6:00								
YC-1	North Park Street	0.15	5.30	11	314	13.07	6.17	Meter
YC-2	West River Drive	0.11	3.88	8	167	6.97	7.06	Meter
YC-3	Lamoreaux Drive	Dry	X	X	X	X	X	X
YC-4	Alpine Avenue (M-37)	Dry	X	X	X	X	X	X
YC-5	Cordes Avenue	Dry	X	X	X	X	X	X
7:00								
YC-1	North Park Street	1.62	57.20	389	119785	4991	4.31	B. Board
YC-2	West River Drive*	1.11	39.19	1262	266268	11094	4.69	B. Board
YC-3	Lamoreaux Drive	0.08	2.82	288	4379	182	6.69	Meter
YC-4	Alpine Avenue (M-37)	0.06	2.12	195	2224	93	4.20	Meter
YC-5	Cordes Avenue	0.03	1.06	852	4858	202	4.59	Meter
8:00								
YC-1	North Park Street	1.60	56.50	629	191297	7971	4.39	B. Board
YC-2	West River Drive*	1.23	43.43	630	147293	6137	5.77	B. Board
YC-3	Lamoreaux Drive	0.06	2.12	177	2019	84	6.69	Meter
YC-4	Alpine Avenue (M-37)	0.1	3.53	459	8725	364	3.90	Meter
YC-5	Cordes Avenue	No Flow	X	X	X	X	5.02	X
9:00								
YC-1	North Park Street	1.06	37.43	206	41506	1729	4.88	B. Board
YC-2	West River Drive*	0.88	31.07	73	12211	509	6.04	B. Board
YC-3	Lamoreaux Drive	0.08	2.82	398	6052	252	6.72	Meter
YC-4	Alpine Avenue (M-37)	0.05	1.77	208	1977	82	4.17	Meter
10:00								
YC-1	North Park Street	0.53	18.71	123	12391	516	5.67	Meter
YC-2	West River Drive*	0.41	14.48	84	6546	273	6.49	Meter
YC-3	Lamoreaux Drive	0.03	1.06	105	599	25	6.82	Meter

Appendix 1

York Creek Watershed Survey Forms for Monitoring Stations 2004

Date: 6/29/2004

Single Site Watershed Survey Data Sheet

Time: 11:00

Waterbody Name: York Creek | County: Kent | Station #: 1

Location: YC-1 | Township: City of Walker | Sec 6 T7N R11W NW ¼ NW ¼

Investigator: BTS, MB | Lat: 43.02628 | Long: -85.66807

Coordinate Determination Method (check the one that applies):

_X_ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (describe _____)

Map Scale (if known _____)

Upstream Side

PHYSICAL HABITAT

BACKGROUND INFORMATION - pg. 18

Event Conditions noted at site	None				
Days since Rain			≥3		
Water Temp./D.O./pH *					
Water Color	Clear				
Waterbody Type-u/s	Stream				
Waterbody Type-d/s	Stream				
Stream Width (ft.)	<10				
Avg. Stream Depth (ft.)	<1				
Water Velocity (ft./sec) *					
Stream Flow Type			L		

PHYSICAL APPEARANCE - pg. 20

(Check all that apply)

Aquatic Plants		
Floating Algae		
Filamentous Algae		
Bacterial Sheen/Slimes		
Turbidity		
Oil Sheen		
Foam		
Trash		

SUBSTRATE (%) – pg. 22

(add to 100%)

Boulder – 10 in. diam.	
Cobble/Gravel –10 to .08 in. diam.	10%
Sand – coarse grain	90%
Silt/Detritus/Muck - fine grain/organic matter	
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	
Unknown	

INSTREAM COVER – pg. 23

(check all that apply)

Undercut Banks	yes
Overhanging Vegetation	yes
Deep Pools	
Boulders	
Aquatic Plants	
Logs or Woody Debris	yes

RIVER MORPHOLOGY – pg. 23

Riffle			
Pool			
Channel			Maintained
Designated Drain	?		

STREAM CORRIDOR – pg. 26

Riparian Veg. Width ft.(L)	<10			
Riparian Veg. Width ft.(R)	<10			
Bank Erosion		L		
Streamside Land Cover		Grass	Shrub	
Stream Canopy %		25-50		

Highest Water Mark (ft.)			1-3			

Stream Cross Section

Adjacent Land Uses

Wetlands		
Shrub or Old Field		
Forest		
Pasture		
Crop Residue		
Rowcrop		
Residential Lawns, Parks	L	R
Impervious Surface	L	R
Disturbed Ground		
No Vegetation		

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 6/29/2004 Station #: 1

Upstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28							
Crop Related Sources				Land Disposal			
Grazing Related Sources				On-site Wastewater Systems			
Intensive Animal Feeding Operations				Silviculture (Forestry NPS)			
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)				Resource Extraction (Mining NPS)			
Channelization				Recreational/Tourism Activities (general)			
Dredging				• Golf Courses			
Removal of Riparian Vegetation	S			• Marinas/Recr. Boating (water releases)			
Bank and Shoreline Erosion/ Modification/Destruction				• Marinas/Recr. Boating (bank or shoreline erosion)			
Flow Regulation/ Modification (Hydrology)				Debris in Water			
Upstream Impoundment				Industrial Pt. Source			
Construction:Highway/Road /Bridge/Culvert				Municipal Pt. Source			
Construction: Land Development				Natural Sources	S		
Urban Runoff (Residential/ Urban NPS)			H	Source(s) Unknown		M	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS: Sample sites upstream of bridge.

Date: 6/29/2004 **Single Site Watershed Survey Data Sheet** Time: 12:35

Waterbody Name: York Creek County: Kent Station #: 2

Location: YC-2 Township: Plainfield Sec 31 T8N R11W NW ¼ SW ¼

Investigator: BTS, MB Lat: 43.0228 Long: -85.66835

Coordinate Determination Method (check the one that applies):

_X_ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (describe _____)

Map Scale (if known _____)

Upstream Side

PHYSICAL HABITAT

BACKGROUND INFORMATION - pg. 18

Event Conditions noted at site	None				
Days since Rain			>3		
Water Temp./D.O./pH *					
Water Color	Clear				
Waterbody Type-u/s	Stream				
Waterbody Type-d/s	Stream				
Stream Width (ft.)	<10				
Avg. Stream Depth (ft.)	<1				
Water Velocity (ft./sec) *					
Stream Flow Type			L		

PHYSICAL APPEARANCE - pg. 20
(Check all that apply)

Aquatic Plants		
Floating Algae		
Filamentous Algae	Present	
Bacterial Sheen/Slimes	Present	
Turbidity		
Oil Sheen		
Foam		
Trash		

SUBSTRATE (%) – pg. 22
(add to 100%)

Boulder – 10 in. diam.	
Cobble/Gravel –10 to .08 in. diam.	
Sand – coarse grain	30%
Silt/Detritus/Muck - fine grain/organic matter	20%
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	50%
Unknown	

INSTREAM COVER – pg. 23
(check all that apply)

Undercut Banks	
Overhanging Vegetation	yes
Deep Pools	
Boulders	
Aquatic Plants	
Logs or Woody Debris	

RIVER MORPHOLOGY – pg. 23

Riffle			
Pool			
Channel			Maintained
Designated Drain	?		

Highest Water Mark (ft.)				3-5		

STREAM CORRIDOR – pg. 26

Riparian Veg. Width ft.(L)	<10			
Riparian Veg. Width ft.(R)		10-30		
Bank Erosion	0			
Streamside Land Cover		Grass	Shrub	Trees
Stream Canopy %	<25			

Stream Cross Section

Adjacent Land Uses

Wetlands		
Shrub or Old Field		
Forest		
Pasture		
Crop Residue		
Rowcrop		
Residential Lawns, Parks		R
Impervious Surface	L	R
Disturbed Ground		
No Vegetation		

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 6/29/2004 **Station #: 2**

Upstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28							
Crop Related Sources				Land Disposal			
Grazing Related Sources				On-site Wastewater Systems			
Intensive Animal Feeding Operations				Silviculture (Forestry NPS)			
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)				Resource Extraction (Mining NPS)			
Channelization				Recreational/Tourism Activities (general)			
Dredging				• Golf Courses			
Removal of Riparian Vegetation				• Marinas/Recr. Boating (water releases)			
Bank and Shoreline Erosion/ Modification/Destruction				• Marinas/Recr. Boating (bank or shoreline erosion)			
Flow Regulation/ Modification (Hydrology)				Debris in Water			
Upstream Impoundment				Industrial Pt. Source			
Construction:Highway/Road /Bridge/Culvert				Municipal Pt. Source			
Construction: Land Development				Natural Sources		M	
Urban Runoff (Residential/ Urban NPS)			H	Source(s) Unknown		M	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS: 100% artificial channel, concrete block Sample site upstream of bridge.

Date: 6/29/2004

Single Site Watershed Survey Data Sheet

Time: 13:10

Waterbody Name: York Creek County: Kent Station #: 3

Location: YC-3 Township: Alpine Sec 25 T8N R12W SW ¼ SW ¼

Investigator: BTS, MB Lat: 43.04362 Long: -85.68653

Coordinate Determination Method (check the one that applies):

_X_ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (describe _____)

Map Scale (if known _____)

Upstream Side

PHYSICAL HABITAT

BACKGROUND INFORMATION - pg. 18

Event Conditions noted at site	None				
Days since Rain			>3		
Water Temp./D.O./pH *					
Water Color	Clear				
Waterbody Type-u/s	Stream				
Waterbody Type-d/s	Stream				
Stream Width (ft.)	<10				
Avg. Stream Depth (ft.)	<1				
Water Velocity (ft./sec) *					
Stream Flow Type			L		

PHYSICAL APPEARANCE - pg. 20

(Check all that apply)

Aquatic Plants		
Floating Algae		
Filamentous Algae		
Bacterial Sheen/Slimes	Present	
Turbidity		
Oil Sheen		
Foam		
Trash		

SUBSTRATE (%) – pg. 22

(add to 100%)

Boulder – 10 in. diam.	
Cobble/Gravel –10 to .08 in. diam.	
Sand – coarse grain	85%
Silt/Detritus/Muck - fine grain/organic matter	
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	15%
Unknown	

INSTREAM COVER – pg. 23

(check all that apply)

Undercut Banks	
Overhanging Vegetation	yes
Deep Pools	
Boulders	
Aquatic Plants	
Logs or Woody Debris	yes

RIVER MORPHOLOGY – pg. 23

Riffle			
Pool			
Channel	Natural		
Designated Drain	?		

Highest Water Mark (ft.)	?					

STREAM CORRIDOR – pg. 26

Riparian Veg. Width ft.(L)				30-100	
Riparian Veg. Width ft.(R)	<10				
Bank Erosion		L			
Streamside Land Cover		Grass	Shrub	Trees	
Stream Canopy %		25-50			

Stream Cross Section

Adjacent Land Uses

Wetlands		
Shrub or Old Field		
Forest	L	
Pasture		
Crop Residue		
Rowcrop		
Residential Lawns, Parks		R
Impervious Surface		
Disturbed Ground		
No Vegetation		

Single Site Watershed Survey Data Sheet (page 2)

Date: 6/29/2004 **Station #: 3**
Upstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28							
Crop Related Sources				Land Disposal			
Grazing Related Sources				On-site Wastewater Systems			
Intensive Animal Feeding Operations				Silviculture (Forestry NPS)			
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)				Resource Extraction (Mining NPS)			
Channelization				Recreational/Tourism Activities (general)			
Dredging				• Golf Courses			
Removal of Riparian Vegetation				• Marinas/Recr. Boating (water releases)			
Bank and Shoreline Erosion/ Modification/Destruction				• Marinas/Recr. Boating (bank or shoreline erosion)			
Flow Regulation/ Modification (Hydrology)				Debris in Water			
Upstream Impoundment				Industrial Pt. Source			
Construction:Highway/Road /Bridge/Culvert				Municipal Pt. Source			
Construction: Land Development				Natural Sources		M	
Urban Runoff (Residential/ Urban NPS)			H	Source(s) Unknown		M	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS: Sample site upstream of bridge.

Date: 6/29/2004

Single Site Watershed Survey Data Sheet

Time: 13:35

Waterbody Name: York Creek County: Kent Station #: 4

Location: YC-4 Township: Alpine Sec 25 T8N R12W SW ¼ SW ¼

Investigator: BTS, MB Lat: 43.0449 Long: -85.68937

Coordinate Determination Method (check the one that applies):

_X_ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (describe _____)

Map Scale (if known _____)

Downstream Side

PHYSICAL HABITAT

BACKGROUND INFORMATION - pg. 18

Event Conditions noted at site	None			
Days since Rain			>3	
Water Temp./D.O./pH *				
Water Color	Clear			
Waterbody Type-u/s	Stream			
Waterbody Type-d/s	Stream			
Stream Width (ft.)	<10			
Avg. Stream Depth (ft.)	<1			
Water Velocity (ft./sec) *				
Stream Flow Type			L	

PHYSICAL APPEARANCE - pg. 20

(Check all that apply)

Aquatic Plants		
Floating Algae		
Filamentous Algae		
Bacterial Sheen/Slimes		
Turbidity		
Oil Sheen		
Foam		
Trash		

SUBSTRATE (%) – pg. 22

(add to 100%)

Boulder – 10 in. diam.	
Cobble/Gravel –10 to .08 in. diam.	5%
Sand – coarse grain	75%
Silt/Detritus/Muck - fine grain/organic matter	20%
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	
Unknown	

INSTREAM COVER – pg. 23

(check all that apply)

Undercut Banks	
Overhanging Vegetation	yes
Deep Pools	
Boulders	
Aquatic Plants	
Logs or Woody Debris	yes

RIVER MORPHOLOGY – pg. 23

Riffle			
Pool			
Channel	Natural		
Designated Drain	?		

STREAM CORRIDOR – pg. 26

Riparian Veg. Width ft.(L)	<10			
Riparian Veg. Width ft.(R)		10-30		
Bank Erosion		L		
Streamside Land Cover		Grass	Shrub	Trees
Stream Canopy %				>50

Highest Water Mark (ft.)	?					

Stream Cross Section

Adjacent Land Uses

Wetlands		
Shrub or Old Field		R
Forest		
Pasture		
Crop Residue		
Rowcrop		
Residential Lawns, Parks		
Impervious Surface	L	
Disturbed Ground		
No Vegetation		

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 6/29/2004 **Station #: 4**
Downstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28							
Crop Related Sources				Land Disposal			
Grazing Related Sources				On-site Wastewater Systems			
Intensive Animal Feeding Operations				Silviculture (Forestry NPS)			
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)				Resource Extraction (Mining NPS)			
Channelization				Recreational/Tourism Activities (general)			
Dredging				• Golf Courses			
Removal of Riparian Vegetation				• Marinas/Recr. Boating (water releases)			
Bank and Shoreline Erosion/ Modification/Destruction				• Marinas/Recr. Boating (bank or shoreline erosion)			
Flow Regulation/ Modification (Hydrology)				Debris in Water			
Upstream Impoundment				Industrial Pt. Source			
Construction:Highway/Road /Bridge/Culvert				Municipal Pt. Source			
Construction: Land Development				Natural Sources	S		
Urban Runoff (Residential/ Urban NPS)			H	Source(s) Unknown		M	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS: Sample site downstream of bridge.

Date: 6/29/2004 **Single Site Watershed Survey Data Sheet** Time: 14:00

Waterbody Name: York Creek County: Kent Station #: 5

Location: YC-5 Township: Alpine Sec 26 T8N R12W SW ¼ SE ¼

Investigator: BTS, MB Lat: 43.04603 Long: -85.69945

Coordinate Determination Method (check the one that applies):

_X_ GPS ___ GPS w/ DBR ___ Digital mapping software ___ Topographic map ___ Other (describe _____)

Map Scale (if known _____)

Downstream Side

PHYSICAL HABITAT

BACKGROUND INFORMATION - pg. 18

Event Conditions noted at site	None				
Days since Rain			>3		
Water Temp./D.O./pH *					
Water Color	Clear				
Waterbody Type-u/s	Stream				
Waterbody Type-d/s	Stream				
Stream Width (ft.)	<10				
Avg. Stream Depth (ft.)	<1				
Water Velocity (ft./sec) *					
Stream Flow Type			L		

PHYSICAL APPEARANCE - pg. 20
(Check all that apply)

Aquatic Plants		
Floating Algae		
Filamentous Algae		
Bacterial Sheen/Slimes		
Turbidity		
Oil Sheen		
Foam		
Trash		

SUBSTRATE (%) – pg. 22
(add to 100%)

Boulder – 10 in. diam.	
Cobble/Gravel –10 to .08 in. diam.	10%
Sand – coarse grain	80%
Silt/Detritus/Muck - fine grain/organic matter	10%
Hardpan/Bedrock – solid clay/rock surface	
Artificial – manmade	
Unknown	

INSTREAM COVER – pg. 23
(check all that apply)

Undercut Banks	
Overhanging Vegetation	
Deep Pools	
Boulders	
Aquatic Plants	
Logs or Woody Debris	yes

RIVER MORPHOLOGY – pg. 23

Riffle			
Pool			
Channel	Natural		
Designated Drain	?		

Highest Water Mark (ft.)	?					

STREAM CORRIDOR – pg. 26

Riparian Veg. Width ft.(L)		10-30		
Riparian Veg. Width ft.(R)	<10			
Bank Erosion		L		
Streamside Land Cover		Grass	Shrub	
Stream Canopy %	<25			

Stream Cross Section

Adjacent Land Uses

Wetlands		
Shrub or Old Field	L	
Forest		
Pasture		R
Crop Residue		
Rowcrop		
Residential Lawns, Parks		
Impervious Surface		
Disturbed Ground		
No Vegetation		

* Optional Data Item

Data Sheet Version 4/27/00

Single Site Watershed Survey Data Sheet (page 2)

Date: 6/29/2004 **Station #: 5**
Downstream Side

POTENTIAL SOURCES (Severity: S – slight; M – moderate; H – high) – pg. 28							
Crop Related Sources				Land Disposal			
Grazing Related Sources				On-site Wastewater Systems			
Intensive Animal Feeding Operations				Silviculture (Forestry NPS)			
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)				Resource Extraction (Mining NPS)			
Channelization				Recreational/Tourism Activities (general)			
Dredging				• Golf Courses			
Removal of Riparian Vegetation				• Marinas/Recr. Boating (water releases)			
Bank and Shoreline Erosion/ Modification/Destruction				• Marinas/Recr. Boating (bank or shoreline erosion)			
Flow Regulation/ Modification (Hydrology)				Debris in Water			
Upstream Impoundment				Industrial Pt. Source			
Construction:Highway/Road /Bridge/Culvert				Municipal Pt. Source			
Construction: Land Development				Natural Sources		M	
Urban Runoff (Residential/ Urban NPS)				Source(s) Unknown		M	

SITE SUMMARY INFORMATION – pg. 33			
SURVEY DIRECTION	N/A	U/S	D/S
SITE SIMILARITY	?	Y	N
OVERALL SITE RANKING	L	M	H
SITE FOLLOW-UP RANK	L	M	H

COMMENTS: Sample site downstream of bridge.

Appendix 2

York Creek Watershed Monitoring Station and Stormwater Outfall Pictures 2004

YC-1 Downstream

YC-1 Bridge

YC-2 Downstream

YC-2 Bridge

YC-3 Downstream

YC-3 Culvert

YC-4 Upstream

YC-4 Bridge

YC-5 Upstream

YC-5 Culvert

YC-5 Culvert

YC-5 Culvert

YC-5 Culvert

Appendix 3

York Creek Watershed

MDEQ Rating Curves 2004

DEQ Michigan Department of Environmental Quality - Land and Water Management Division

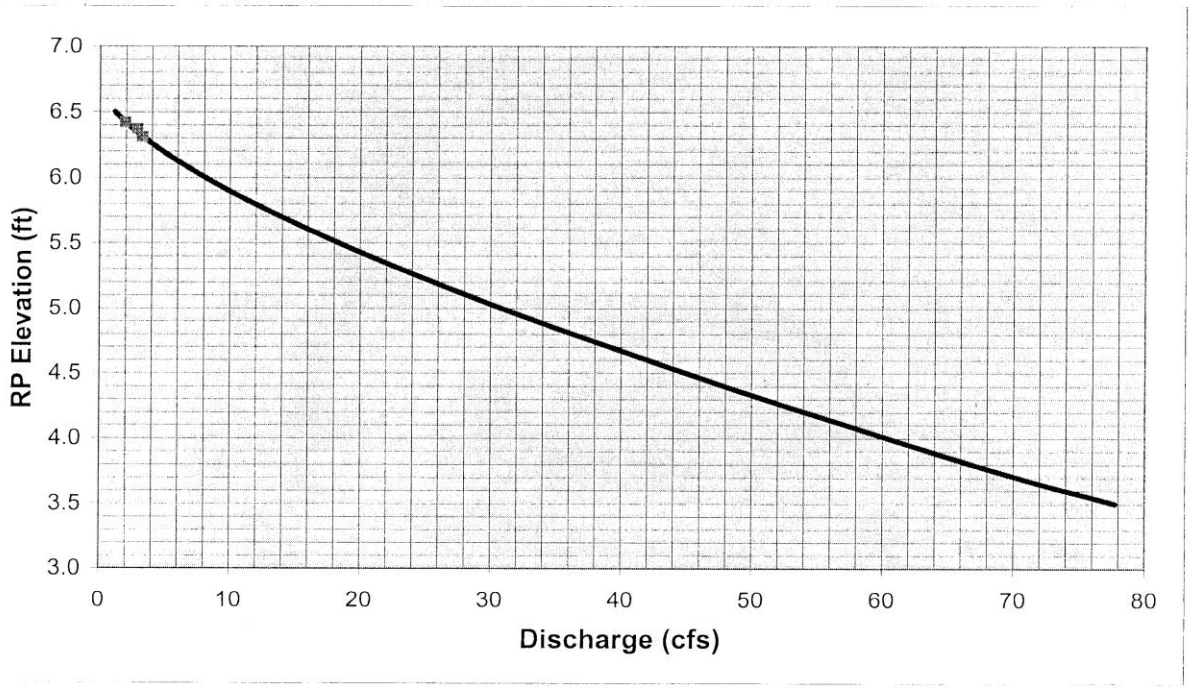
Stage-Discharge Rating Curve

Station: YC-01, 04118590, York Creek at North Park Street

RP: Downstream side of bridge a V notched on the deck of the bridge one foot from right edge of water.

R.P.	Discharge
(ft)	(cfs)
6.50	1.15
6.35	2.76
6.20	4.81
6.05	7.21
5.90	9.91
5.75	12.88
5.60	16.08
5.45	19.50
5.30	23.10
5.15	26.88
5.00	30.82
4.85	34.91
4.70	39.14
4.55	43.49
4.40	47.96
4.25	52.55
4.10	57.23
3.95	62.02
3.80	66.89
3.65	72.05
3.50	77.75

Measurements		
Date	Discharge	RP
04/14/04	1.95	6.42
05/14/04	3.27	6.31
7/30/2004	2.88	6.37



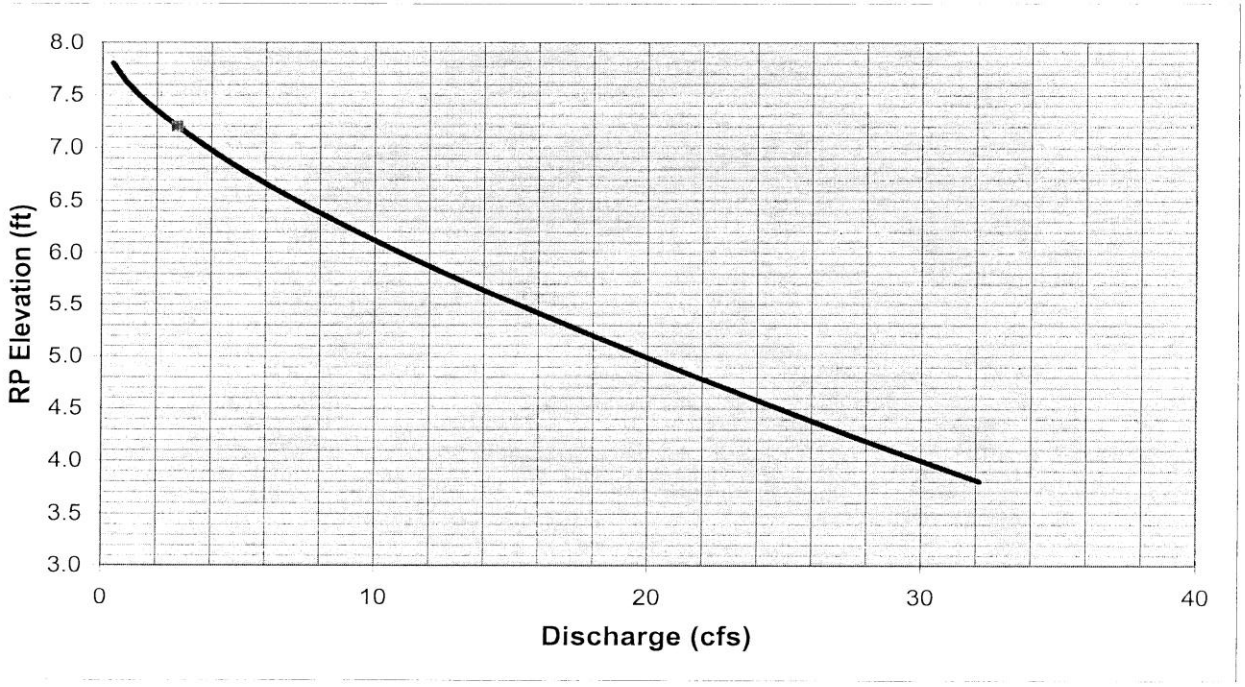
10/27/2004

DEQ Michigan Department of Environmental Quality - Land and Water Management Division
Stage-Discharge Rating Curve

Station: YC-02, York Creek at West River Drive

RP: Upstream side of bridge a V notched on the middle of the deck of the bridge.

R.P.	Discharge	Measurements		
(ft)	(cfs)	Date	Discharge	RP
7.8	0.39	07/30/04	2.75	7.20
7.6	0.98			
7.4	1.78			
7.2	2.75			
7.0	3.86			
6.8	5.08			
6.6	6.41			
6.4	7.84			
6.2	9.36			
6.0	10.95			
5.8	12.61			
5.6	14.34			
5.4	16.13			
5.2	17.98			
5.0	19.87			
4.8	21.81			
4.6	23.80			
4.4	25.83			
4.2	27.90			
4.0	30.00			
3.8	32.14			
3.6	34.31			



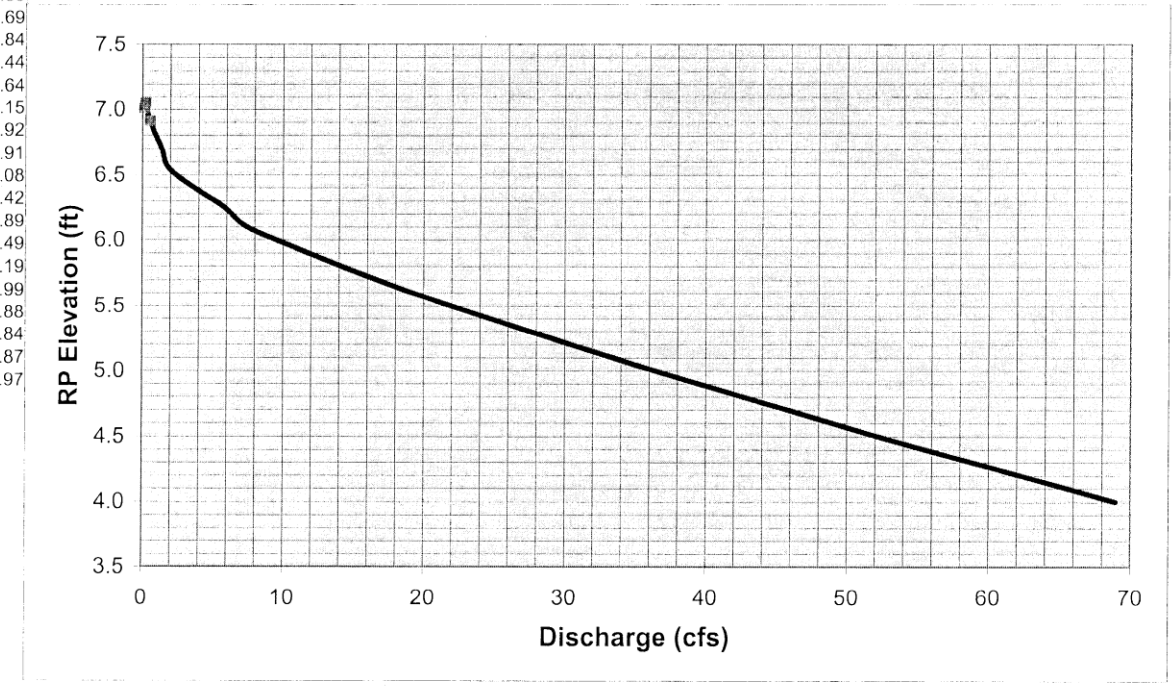
10/27/2004

DEQ Michigan Department of Environmental Quality - Land and Water Management Division
Stage-Discharge Rating Curve

Station: YC-03, York Creek at Lamoreaux Street

RP: Upstream side of culvert a notched on top of the culvert.

R.P.	Discharge	Measurements		
(ft)	(cfs)	Date	Discharge	RP
7.00	0.27	04/14/04	0.15	7.01
6.85	0.75	05/14/04	0.54	6.91
6.70	1.38	7/30/2004	0.23	7.05
6.55	1.89			
6.40	3.69			
6.25	5.84			
6.10	7.44			
5.95	10.64			
5.80	14.15			
5.65	17.92			
5.50	21.91			
5.35	26.08			
5.20	30.42			
5.05	34.89			
4.90	39.49			
4.75	44.19			
4.60	48.99			
4.45	53.88			
4.30	58.84			
4.15	63.87			
4.00	68.97			



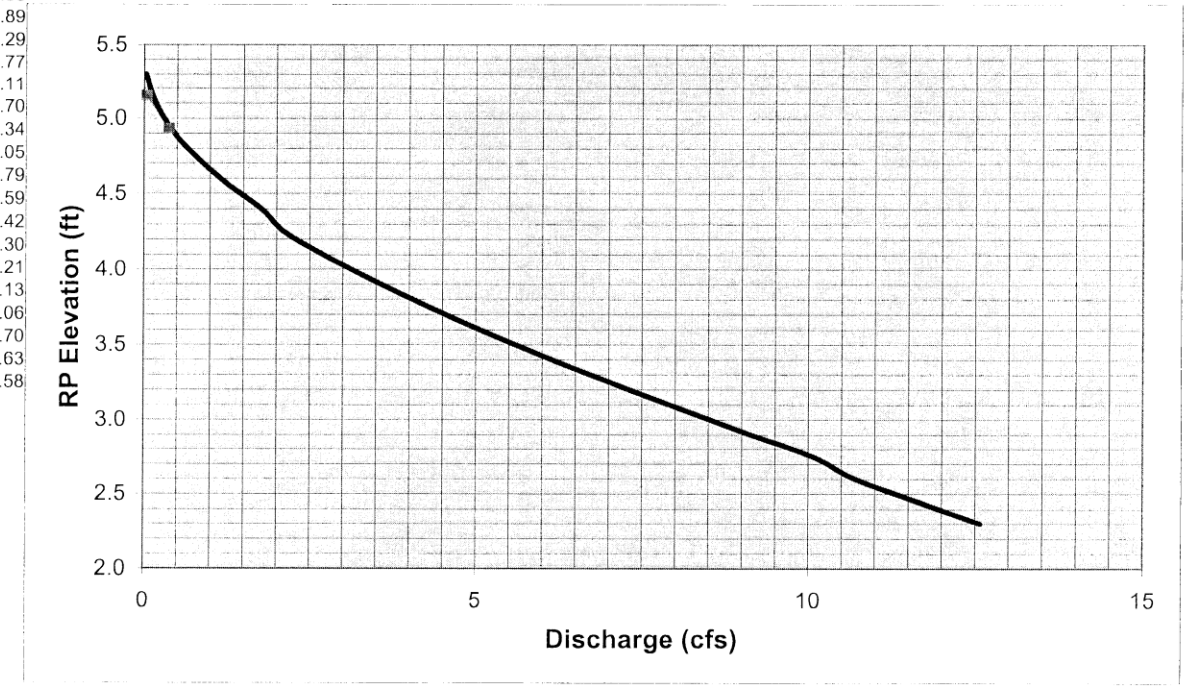
10/27/2004

DEQ Michigan Department of Environmental Quality - Land and Water Management Division
Stage-Discharge Rating Curve

Station: YC-05, York Creek at Cordes Avenue

RP: Downstream side of oval concrete culvert.

R.P.	Discharge	Measurements		
(ft)	(cfs)	Date	Discharge	RP
5.30	0.03	04/14/04	0.04	5.15
5.15	0.13	05/14/04	0.38	4.93
5.00	0.30	7/30/2004	0	
4.85	0.55			
4.70	0.89			
4.55	1.29			
4.40	1.77			
4.25	2.11			
4.10	2.70			
3.95	3.34			
3.80	4.05			
3.65	4.79			
3.50	5.59			
3.35	6.42			
3.20	7.30			
3.05	8.21			
2.90	9.13			
2.75	10.06			
2.60	10.70			
2.45	11.63			
2.30	12.58			



10/28/2004